THE PARIETAL INCISION IN ABDOMINAL SURGERY.

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IN the earlier days of abdominal surgery, when everything was good if only the life were saved, little attention was paid to the parietal incision either in the making or the closing of it. Provided that it gave easy access to the abdominal work, and that it healed kindly, little more thought was given to it. Now that the prime end of life-saving has been secured we are able to devote a closer and keener attention to the ways of making and of closing the incision in the parietes. It is my purpose in this paper to try to set out and discuss the leading principles which ought to guide the enlightened surgeon in this subsidiary but not unimportant part of abdominal surgery.

The first requisite of the abdominal incision is, of course, that it shall provide easy or at least satisfactory access to the work to be done. Every other consideration must give way to this. The next requisite is that it shall not appreciably add to the patient's risk. Admitting these leading requisites there are still many subsidiary issues which demand attention. Such are, the securing of provision against the occurrence of ventral hernia; the selection of a point in the parietes most suitable for the fixation of a hollow viscus or the wall of an abscess or cyst; the provision of muscular sphincteric action around a fistula; the making of an incision through which both exploration and treatment may be carried out. The one incision must seek to meet all requirements; and thus, seeking to unite a maximum of advantages with a minimum of disadvantages, immediate as well as remote, many incisions will be, in a fashion, compromises. But always provision of room and avoidance of risk must be the leading motives. For example,—probably the worst incision possible as regards weakening of the parietes is a transverse section of the recti passing on through the linea semilunaris; but such an incision is the best possible as providing easy access to deep underlying work. In such an operation as pylorectomy, with fixation of growth and perhaps enlargement of glands, the urgent necessities of the freest access and of the saving of life would make us throw aside all remote considerations as to ventral weakening or protrusion. A vertical incision in the middle line or passing through fibres of the rectus cramps the space for operating, but leaves no risk of hernia. In an actual case other considerations would arise. Thus with thick muscular parietes, a deep abdomen, and a necessity for extensive and delicate work inside, a transverse, or partly transverse, section of rectal fibres would be adopted. With thin or lax parietes, a shallow abdomen, a mobile growth, and no likelihood of delicate work inside, a vertical incision with separation of muscular fibres would be sufficient. In other cases a combination of methods would be adopted; perhaps a primary and harmless incision for diagnosis and guidance; and a continuation of it for the operation regardless of everything but the saving of life and the provision of room. With this concrete and extreme example before us there is, I trust, no possibility of misapprehending the relative weights to be given to the principles and practices to be considered

Considerations Involved in the Selection of the Incision.

The principles involved in the selection of the incision will be discussed separately in their relations to muscle; to fascia; to the gross structure of the parietes in regard to thickness, density, and mobility, and to the length of the incision. Then a practical and critical exposition of these principles will be made with regard to the common incisions in use. Lastly, the practical closure of the incision and the cure of parietal and umbilical hernia will be described.

The Abdominal Muscles.—There is no doubt that the presence of intact muscular fibre is the best provision against hernia. Hernia takes place through fascial tissues, not muscular. Any transverse division of muscular fibre leaves a permanent and irremediable weakness at the seat of division. However closely and accurately the divided fibres are joined, the cicatrix will stretch. And a further and additional weakness is caused by the atrophy of the divided ends for some distance away from the cicatricial union. Nothing can prevent this. Close suturing may keep up close apposition for months or even years, but stretching of the uniting scar will certainly take place in the end, with subsequent weakening of the parietes or hernia.

It may, therefore, be laid down as a first law or principle that *the line of parietal incision should be made parallel with the direction of the most important muscular fibres.*

The Parietal Fasciæ and Aponeuroses.—Fascia, like muscle, once divided can never be replaced. The new tissue is the same for fascia as for muscle, and is equally capable of being stretched. The tensile power of a thick aponeurosis like that of the external oblique is enormous; the thin strip of cicatrix which unites the divided ends of such an aponeurosis is quite inadequate to bear the original strain. If there is one intact layer of muscle behind or in front of a divided fascia, the risk of hernia is much diminished. And, also, if intact muscular fibres are set parallel to an incision through fascia the risk of hernia is lessened. The division of the linea alba or the linea semilunaris would be followed by hernia more often than it is were it not that the sheath of the rectus is very frequently opened and the muscular fibres directly brought into the wound region. Transverse division of aponeurotic fibres is most harmful where muscle above or below is thinnest; where muscle is abundant, as in the lumbar region, division of aponeuroses is least harmful.

A second law may be laid down: *Separate where possible and do not divide aponeurotic fibres; where division is necessary, let it be in a direction which will permit of the leaving intact one or other of the muscular layers behind the division, or in front of it, or parallel to it.* If no one of these practices is possible, then a *flap entrance* should be made,—that is to say, the weak points do not all overlie; they are at different levels in the parietes when union is made. We might reflect skin and aponeurosis, and open muscle at the base of the flap in the lower abdomen; or we might reflect skin and muscle in a flap near the edge of the ribs, and open the deep fascia (here very strong) at the base of the flap.

The Condition of the Parietes as to Thickness, Density, and Fixity.—Considerations having in view the gross condition of the parietes as to excessive thickness, density and incapability of being dilated, and fixation close to any of the bony margins, must influence us occasionally.

Thus, enormous thickness from fat or from fat and muscle combined would forbid any incision in the lumbar region, through which intestine might have to be brought. Again, although we get nearer to the colon by an incision carried well back in the loin, the advantage is nullified by the thickness of the parietes here, making it difficult to separate them, and closing in upon the work right down to it. On the other hand, an incision through these parietes is more easily separated and leaves a free space around the seat of operation. As to fixity of parietes, the difficulty would be well exemplified in the case of a powerful muscular man in whom it was necessary to suture a rent in the bladder low down. To get mobility of incision, it is not wise to go too close to the ribs or the crest of the ilium or the pubes, then the opening cannot be easily depressed or moved about. It often saves in length to have the incision mobile over the work.

A third law may be made: *Keep away from the bony margins, and avoid the thickest and least mobile parts of the parietes.*

Length of Incision.—A mean that gives free access to the work and will not unduly add to the weakness of the abdomen and prolong the operation in its suturing is to be sought. Often the length of the incision is determined by the tumor if it is solid. The seeking should be for shortness; better put up with a little extra difficulty for a minute or two than add an inch to the length of the incision. But no serious detail should for a moment be rendered more difficult to deal with for the sake of avoiding a prolongation of the incision. The actual length of the incision must have directly an infinitesimal influence on the mortality. Indirectly by prolonging the time to be given to the operation it would influence mortality more. And remotely a long incision adds by so much as its length to the probability of the occurrence of ventral hernia. In some operations the length of the incision is simply the space between encroaching bones. Here the length is limited for us.

As regards weakening of the parietes, the length of the incision is of less importance than its direction. Thus an incision passing between the fibres of the rectus in their whole length would be less likely to result in hernia than a transverse incision through the fibres an inch or two long. When fibres are separated, a longer incision is necessary than when they are divided, but the ultimate result to the patient is better.

The fourth law is: *Let the incision be as short as is consistent with efficiency. A long incision with separation of muscular and aponeurotic fibres is better than a short one with division of fibres.*

With the help of the accompanying figures (1 and 2) an attempt may be made practically to apply the principles enumerated. They are intended to show the situation of the usual incisions made through the parietes and their relation to the direction of the chief muscular and fascial fibres. The external oblique muscle is shown in groups of parallel lines; the internal oblique in single wavy lines; and the transversalis in interrupted single lines.

In Fig. 1 the incisions are shown on the anterior aspect of the abdomen.

Incision No. 1, in the middle line between the xiphoid cartilage and the umbilicus, gives access to the greater part of the stomach; through it, if the parietes are lax and thin, most of the operations on the stomach may be performed. If it is made a little to the right, freer access is given to the pylorus; moved towards the left, the body of the stomach in operations for perforation or the removal of foreign bodies would be more easily reached. Where the stomach is contracted, however, and where it has to be fixed and opened (gastrostomy), and the most direct access is essential, such an incision as No. 12 is usually more suitable. Incision No. 2 divides the fibres of the rectus, but gives very free access in such a delicate and difficult operation as

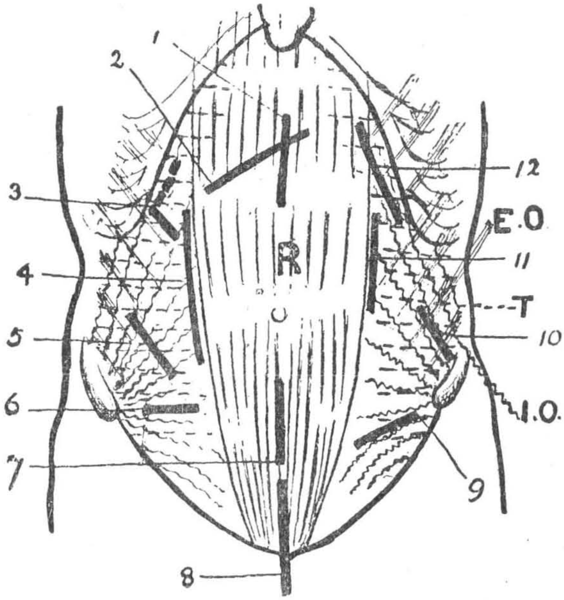

FIG. 1.—Diagram to show relations of chief incisions to directions of muscular fibres in anterior abdomen.

E. O. External oblique muscle (═══).
I. O. Internal oblique muscle (〰〰).
T. Transversalis muscle (— — —).

1. Incision for gastrotomy, gastrorrhaphy, hepatotomy, etc. (left lobe).
2. Pylorectomy,—special cases.
3. Cholecystotomy,—the dotted line an addition for deep operations on the ducts.
4. Langenbuch's incision for nephrectomy, colectomy, etc.
5. Incision for operations on cæcum and appendix vermiformis.
6. Incision for evacuation of collections in broad ligament.
7. Ovariotomy and operations on uterus and appendages.
8. For operations on bladder and symphysis.
9. Another incision to expose collections between layers of pelvic peritoneum.
10. Colostomy, colectomy, etc.
11. Short Langenbuch's incision,—kidney, spleen, tail of pancreas, etc.
12. Gastrostomy.

pylorectomy. Such an incision leaves the abdominal wall permanently weakened.

Incision No. 3 (gall-bladder operations) has regard to the fibres of the external oblique, which here are, perhaps, the most important, and the incision separates but does not divide them. An incision skirting the margin of the ribs and following the fibres of the internal oblique is almost quite as good. For deep operations on the ducts, an additional incision (shown in dotted line) along the margin of the ribs and following the internal oblique fibres adds greatly to the space without materially weakening the wall.

No. 4, a long Langenbuch incision through the linea semilunaris, gives transperitoneal access to the kidney for certain operations, to the duodenum, and, in its upper extremities, to the beginning of the transverse colon. On the left side, No. 11, a shorter incision, gives access to kidney, spleen, tail of pancreas, and the splenic flexure of the colon. Langenbuch's is an excellent incision as regards freedom of access, all the flat muscles tend to draw it away from the rectus. As freedom of access is of prime importance in most of the operations done through this incision it cannot be given up, but it should not be forgotten that this tendency of the flat muscles to cause gaping conduces to ventral hernia, and that an incision made a little inward and separating the fibres of the recti greatly diminishes this risk. In this respect division of the linea semilunaris is worse than division of the linea alba. Muscular action helps to close the latter incision; it makes the former gape.

No. 5 is a good incision for operations on the vermiform appendix and cæcum. It has regard to the muscular fibres and aponeurosis of the external oblique, but it divides the internal oblique and transversalis. For prevention of hernia it is not such a good incision as one almost vertical, following the fibres of the internal oblique, which are here very thick; but such an incision, in case of its being necessary to prolong it upward, leads away from the disease, while the other leads towards the disease. In many cases the fibres of the internal oblique and transversalis may be separated and retracted in the wound, so that no division is necessary. In resection of the cæcum, the incision would have to be longer than that shown. This incision would not be good for colostomy, as it leaves the sharp edge of the oblique aponeurosis, and divides the muscles which act as sphincters. If the oblique and transversalis were teased apart, and the edge of the aponeurosis divided, it would do very well for colostomy.

No. 6 is a bad incision as regards weakening the abdominal wall, for it divides the aponeurosis of the external oblique at its strongest part, and leaves not very strong muscular fibres behind it. No. 9, on the opposite side, a little lower down, is a better one, for it causes less divisions of the fibres of the aponeurosis, and still keeps parallel to the fibres of the internal oblique. Both incisions are made so as to be directly over some collection of fluid in either of the broad ligaments where drainage must be carried out. The sac must be stitched to the wound; and as such sacs are often friable, and do not bear stitch-tension, it is wise to seek an opening as close as possible to the surface of the collection of fluid. A vertical incision here is the worst possible.

No. 7 is the usual time-honored incision for operations on the ovaries and uterus. It is extremely doubtful if it is the best as regards prevention of hernia; in fact, it is almost certain that an incision passing between the fibres of the rectus would be better in this sense. But the rectus, as a matter of fact, is nearly always exposed, and no muscular fibres being divided, the risks of hernia are here not great. As a shorter incision through the linea alba suffices than through fibres, so the harm done is probably not great.

No. 8 is for operations on the bladder, and in its lower portion for division of the symphysis. Here it is not easy to separate the fibres of the rectus, and in operations, such as resection or suture, involving very delicate manipulations, it may be necessary to divide the rectus. This is best done close to the bone; a piece of bone may well be removed with the muscle, and wired in place after operation. Where this is done, an incision of this shape ⅄ may be performed, the skin flap being turned downward, and the muscle raised upward.

No. 10 is a useful incision for certain operations on the descending and sigmoid colon. It may be short; for, dividing the external oblique where it is becoming aponeurotic, it gapes; by separating the parallel fibres of the internal oblique and retracting those of the transversalis, an excellent sphincteric action may be secured. This would be specially valuable in patients with thin parietes. This following of the fibres of the internal oblique will, by going behind the anterior superior spine, give an almost

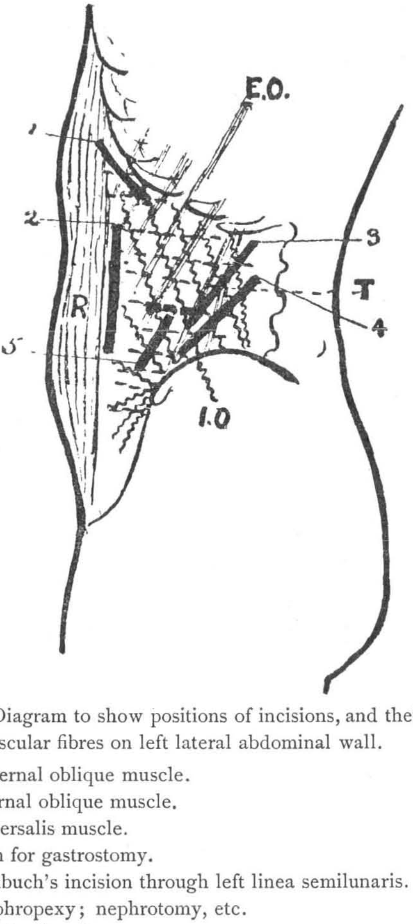

FIG. 2.—Diagram to show positions of incisions, and their relation to muscular fibres on left lateral abdominal wall.

E. O. External oblique muscle.
I. O. Internal oblique muscle.
T. Transversalis muscle.
1. Incision for gastrostomy.
2. Langenbuch's incision through left linea semilunaris.
3. For nephropexy; nephrotomy, etc.
4. For left lumbocolostomy.
5. For laparocolostomy.

vertical incision. In stout patients, where it may be wise to keep nearer to the middle line, such an incision as No. 5, in the lateral view (Fig. 2), would be preferable.

Incisions 11 and 12 have already been referred to.

In Fig. 2 a lateral view of the left side of the abdomen is given. Incision No. 1, for gastrostomy, is the same as No. 12 in Fig. 1. It divides fibres of the oblique and transversalis muscles, and, if the rectus is broad, some of its fibres as well. In one method of operating, the outer fibres of the rectus, separated, are made to surround and grasp the stomach wall drawn through the gap (Fig. 3). Rarely only rectus is divided; this is when the muscle is very broad; not infrequently the rectus is not seen at all; this is when it is narrow.

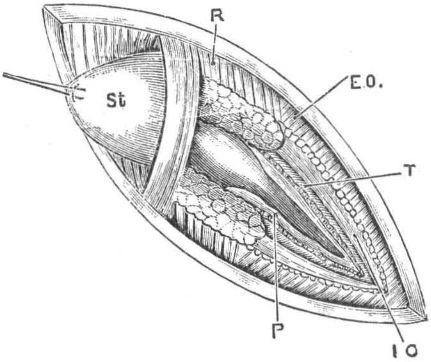

FIG. 3.—Drawing (life-size) of the incision for gastrostomy (No. 1, Fig. 2; No. 12, Fig. 1).

R. Rectus muscle.
E. O. External oblique muscle.
I. O. Internal oblique muscle.
T. Transversalis muscle.
The lines leading to the letters are in the direction of the muscular fibres.
P. Peritoneum.
St. Stomach drawn through separated fibres of rectus muscle.

No. 2, the Langenbuch incision, has already been described (Nos. 4 and 11 in Fig. 1).

No. 5 is a good incision for laparocolostomy. It follows the fibres of the external oblique; and, as it passes diagonally through those of the internal oblique and transversalis, a small division of the fibres of these muscles, with retraction, or retraction without division at all (which is best), will provide a useful sphincteric action around the gut in the formation of artificial anus. If the aponeurosis comes far back it ought to be notched, for it is liable to close in on the gut and narrow the anal orifice. An almost vertical incision, leaving intact the fibres of the internal oblique, is, perhaps, equally good for colostomy. It is not quite so convenient in operating, and I have thought the retraction of the divided oblique aponeurosis permits more ectropion of the mucous membrane of the gut. But this is a small matter.

Nos. 3 and 4, for retroperitoneal operations on the kidney and descending colon, have no regard to direction of muscular fibres, but are planned simply to provide facility of access. The most is made of the limited costo-iliac space. No. 3, for renal operations, goes as close up as is safe to the last rib, and as far back at the top as is convenient to avoid the thick muscles of the loin. It may divide a few fibres of the quadratus lumborum. If this incision has to be enlarged, it is best done by one running transversely across the abdomen from the lower extremity of the first incision (shown in interrupted line, Fig. 2). Such an incision divides both obliques, but leaves the transversalis.

No. 4 is the usual incision for lumbocolostomy. It has regard simply to facility of direct access to the colon, and is determined by this and the position of iliac crest. Muscles are ignored; there is little tendency to hernia here.

Many other points might be dwelt upon in relation to each incision. But, perhaps, these remarks will suffice to indicate the application of the principles enunciated.

No regard whatever has been paid to the division of vessels. With the exception of the deep epigastric, there is no vessel to be encountered whose division need give us a moment's anxiety or even consideration. Forcipressure suffices for all save the deep epigastric, which requires ligature. Small muscular branches in the lumbar operations may be numerous, but rarely require ligation.

THE MAKING OF THE INCISION.

As to the making of the incision in the situation selected certain routine procedures may be described; but the skilful surgeon will adopt a separate method for every case.

The first incision divides the skin and superficial fascia with its varying amount of fat. This, according to the position selected, will expose either dense fascial structures, as in the linea alba, the linea semilunaris, or occasionally the fascia lumborum, or strong fibrous aponeurosis, as that of the external oblique muscle; or the thin fascia that covers muscles away from the strong aponeuroses, or any combination of these.

In the linea alba, unless the abdominal walls are distended and the recti separated, one or other of the rectal sheaths is entered, and the fascial line, accurately speaking, is not divided at all. There is no harm in this. Indeed, I think exposure of the bare fibres of one of the muscles has, on grounds described above, several advantages. This thick, fibrous layer is now divided with scalpel or scissors for the whole length of the cutaneous incision. Below the fold of Douglas there is now nothing to divide but subperitoneal fatty tissue and peritoneum. The left forefinger is moved from top to bottom of the wound, a little of the fat pushed on one side, and the peritoneum caught by catch-forceps and pulled out. The peritoneum is now pulled forward out of the wound, another forceps is placed close to the first, and the sharp raised fold of peritoneum is sawed through by a scalpel. The smallest cut permits the air to rush in, and the bowels at once fall back. The opening is made large enough to admit the forefinger, and the peritoneum is then divided from end to end of the wound by scissors guided by the finger.

A glance at the divided peritoneum will show at once whether there is any bleeding which requires forcipressure. Every visible bleeding point has a forceps placed on it. Hæmostasis will be complete in a few minutes, during which the forceps are left hanging over the parietes.

If the incision is made in the linea alba above Douglas's fold or above the umbilicus, and if, as is usual, one or other sheath of rectus is entered, we have to divide the united aponeuroses of the internal oblique and transversalis before reaching the subperitoneal fat. As to whether the umbilicus should be traversed or not in incision going above and below it, opinions are divided. On the whole, I think it is best to avoid it: by passing to the left of the umbilicus we avoid the round ligament of the liver; we introduce no necessity for complicated suturing; and we continue to have the advantage of exposed rectal muscle in the wound.

An incision in the linea semilunaris is surgically almost the same as in the linea alba. Here, however, the incision should fall to the inside of the fascial line, because thus we minimize the weakening of the parietes which follows. If the fascia is accurately divided, a narrow and not easily organized line of cicatrix is all that is left to counteract the tendency to gaping, which the united action of the flat muscles induces. If the sheath is entered by division of the anterior layer of united aponeuroses, the muscular fibres pushed inward, and the posterior aponeurosis divided opposite the line of the anterior, we get, if subsequent suturing is properly carried out, a broad, concavo-convex apposition of surfaces, which is more fully able to bear subsequent strain.

Incisions made away from superficial aponeurosis are chiefly in the upper and lateral regions of the abdomen. Whenever such an incision is made, the lines of direction of the bundles of at least two of the flat muscles or their fascia must be divided either transversely or diagonally. Such division, if essential, should always be as limited as possible. Often in parietes which are not very muscular it is possible to enter the abdomen without dividing any of the fibres. By separation with the forefinger and retraction of the separated bundles sufficient space is given for many purposes. In colostomy, the attempt to enter without division of muscular fibres should always be made; at least the fibres of one of the muscles should be left intact. It is always easy enough to separate the fibres with the forefinger if the division between two leading bundles is selected. In operations for appendicitis the same rule should be observed. Bleeding is very slight or absent.

CLOSING THE PARIETAL INCISION.

A great deal of attention has recently been paid to the closing of the parietal incision. The methods described are almost as varied as the descriptions. Primary healing is easily and almost universally secured by any method. Stitch abscesses result from filth, and are avoidable. The variety of method, therefore, arises chiefly from a desire to avoid the subsequent occurrence of ventral hernia. I have already argued that the occurrence of ventral hernia depends more on the way in which the incision is made than on the way in which it is sutured; and as regards the best work of the best surgeons this is certainly true. There are only a few good methods of closing the wound; there is an endless variety of bad methods in making it.

Three leading principles may be selected for our guidance in the closing of a parietal incision,—

I. *The Apposition of Raw Surfaces should be as Broad as Possible.*—The tensile power of a given surface of growing cicatrix may be taken as identical for every wound. The aggregate tensile power is increased in direct ratio to the surface involved,—in other words, the whole binding power is greater the deeper the wound. This should lead us to be careful of drawing in or narrowing the wound surface. Where the parietes are very thin, as at the umbilicus, a deliberate outfolding of skin and peritoneum, so as to give a flange-stitch, should be made. Where the parietes are moderately thin, a judicious manipulation of the needle will bring much of the muscle and deeper tissues into the wound, and cause eversion of skin and of peritoneum when the suture is tightened.

II. *Each divided Structure should be placed and kept Opposite its Fellow.*—Thus fat should lie in contact with fat, fascia with fascia, muscle with muscle, and peritoneum with peritoneum. The wisdom of this practice is self-evident; but its importance has, I think, been exaggerated. If there were one variety of cicatricial tissue for muscle, and another for fascia, and another for areolar tissue, the accurate union of each layer would be essential. But as the young tissue is the same for all, and as each layer will certainly appropriate its own bundle of fibres from the common stock, little harm can be done if apposition is not accurate. I look upon the separate suturing of each parietal layer as a refinement always, and as a superfluity usually, provided that the single-group suture is properly placed. Sometimes it may be necessary to carry out separate suturing, in part at least; this would arise most frequently in the upper abdomen where the parietes are very thin and muscular fibres have been divided.

One objection to the suture of the separate layers is that it devascularizes the lines of union and narrows them. Such a suture leaves a series of gaps to be filled with clot, between each layer at the line of junction (see Fig. 4, B), there is not one flush meeting of the whole of the rawed surfaces as in the mass-suture. Also the cicatricial tissue dipping into these hollows is longer, therefore more easily stretch; while the bulk of it in depth not being so great it is not so strong.

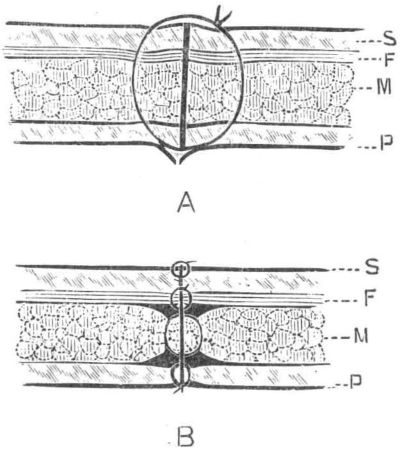

FIG. 4.—Transverse section of sutured parietal wound.

A. Interrupted mass-suture.
B. Continuous separate suture.
S. Skin and subcutaneous tissue.
F. Fascia.
M. Muscle.
P. Peritoneum.

III. *The Sutures should not be removed early*.—We are all too fond of removing the sutures early. "Sutures removed on the seventh day" is often quoted as a proof of easy and quick convalescence. Early removal of sutures is, I think, a mistake. The good that has undoubtedly followed the employment of buried sutures must arise, it seems to me, chiefly from the fact that we cannot remove them at the end of a week; they continue to maintain apposition for three or four weeks, or even longer.

At the end of a week the uniting medium is very easily stretched; and it is by no means strong at the end of a fortnight. A very little stretching then means a great increase of the potentiality of being stretched later. If the parts are kept together firmly for three weeks or a month, we have done the best that we can do to prevent stretching of the cicatrix.

In the actual carrying out of these principles, a suture that is non-absorbent, and will not act as a capillary drain upward or downward, is essential. For this purpose Bantock's silkworm gut stands unrivalled. It is scarcely possible to keep a row of silk sutures in an abdominal wound for three weeks without getting suppuration. Metal wire has no advantage over silkworm gut, and has several disadvantages. The only drawback to silkworm gut is that it is liable at the end of three weeks to become completely buried. If the ends are kept long and occasionally pulled upon, this drawback is easily averted.

For the placing of the sutures, a long, curved needle with a handle is the best. It must be long if it is to include both sides of the wound. It must be curved if it is to pick up a large bundle of muscular fibre and go in and come out near the margins of the wound. And such a needle cannot be manipulated deftly if it has not a handle. A long curved Hagedorn needle of different sizes set in a line with the handle is what I use and prefer to every other.

As to the actual suturing, a few words may not be amiss. Firstly, as to mass-sutures, they are placed from two to four to the inch, according to the thickness and position of the wound. A sponge laid between the wound and the bowels keeps them out of the way and absorbs the few drops of blood that escape through the punctures. The needle is inserted into the skin near to the edge of the incision; it is then made to pass outward into the areolar tissue; it takes a good hold of any fibrous layer that overlies the muscle, then it plunges deeply into the muscle and is brought out below it. Finally, it hooks up any deep fascia and picks up fibrous tissue underlying the peritoneum. *It does not pierce the peritoneum.* The needle is carried through on the opposite side in the same way in reverse order, then it is threaded and withdrawn. With a little practice with this needle the sutures may be placed with great rapidity. The depth of union sought may be regulated by the amount of areolar and muscular tissue included in the deep tissues.

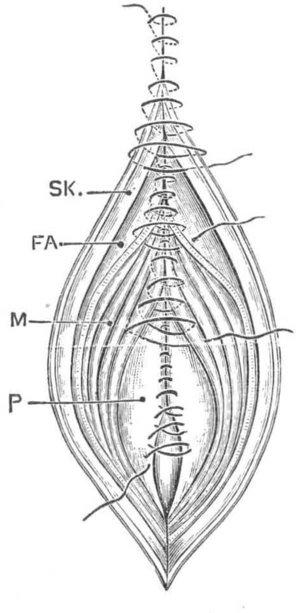

FIG. 5.—Application of continuous sutures to separate layers in closing of median abdominal incision.

Sk. Skin.
Fa. Fascia.
M. Muscle.
P. Peritoneum.

When the sutures are placed, the ends are gathered together in the two hands of the assistant, and the sponge removed while he pulls them forward, and so brings the wound together. Then they are tied. The appearance in transverse section of a wound sutured in this way is shown in Fig. 4, A.

If buried sutures are used they are usually continuous, and they are made to include the individual layers. In Fig. 5 suture of all the layers is shown, the sutures being somewhat crowded. Catgut, carefully prepared, or ox-aorta, or kangaroo-tendon may be used. I have often used silkworm gut as a buried suture, and found it gave no trouble afterwards. An ordinary Hagedorn needle with holder does well for the placing of the continuous suture.

In transverse section (Fig. 4, B) the effect of this method of suturing is shown. The muscular edge is compressed instead of broadened, and gaps are left above and below, which shelter blood-clot. A good grip of fascia should be taken so as to bring into apposition folded surfaces, and not merely cut edges.

As germane to the subject, and as involving the principles discussed, short descriptions of operations for ventral hernia and for umbilical hernia may here be given.

OPERATION FOR VENTRAL HERNIA.

Ventral hernia, so-called, is simply a stretching of scar tissue, which permits the abdominal contents to escape through the parietes, and to bulge outwardly under the skin. There is no narrow neck, as in umbilical hernia, and no dissection of skin from parietes by burrowing omentum or intestine, as in umbilical hernia. The hernial sac is simply stretched peritoneum, the coverings are stretched cicatricial tissue with a little fat and stretched skin (Fig. 6).

To cure this condition, it is necessary to remove or push aside the redundant and attenuated tissues; and bring into contact, and keep in contact, the thick and non-yielding parietes.

To do this satisfactorily, it is rarely necessary to enter the abdominal cavity. The areolar tissue between the skin and the peritoneum is entered by a small incision along the chief diameter of the hernia, and then, with finger or blunt director, helped occasionally by cutting; they are completely separated down to the margins of the wound. Any great superfluity of skin is removed, but surprisingly large flaps may be left; and if they are turned outward and united by raw surfaces, add to the strength of the union. The peritoneal sac is turned in towards the abdomen. If very abundant, it may be gathered together by a continuous purse-string suture carried through the areolar tissue, when it will form a useful pad or buffer between intestines and incision. If not very voluminous, this peritoneal sac may be gathered in with the suture which closes the parietal incision, care being taken that each stitch takes in only areolar tissue, and that no part of the peritoneal sac is pulled between the joined parietes (Fig. 6).

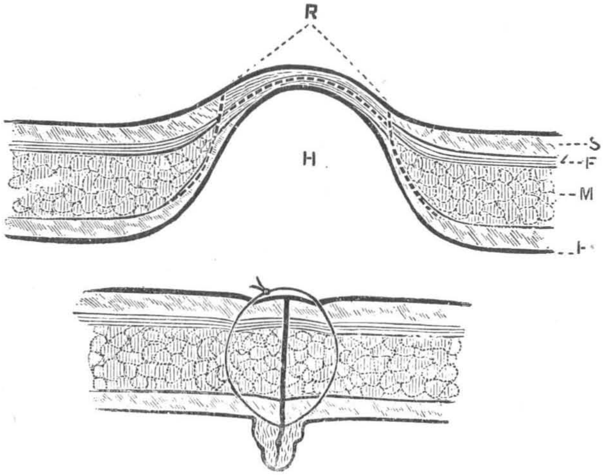

FIG. 6.—Ventral hernia and method of operative cure.
The upper figure shows in transverse section the parietes involved and the lines of incision (dotted).

H. Placed in the hernial pouch.
R. Skin between dotted lines to be removed.
S. Skin.
F. Fascia.
M. Muscle.
P. Peritoneum.

The lower figure shows the wound after closure. Redundant skin has been removed.
The inturned peritoneum is shown as a pendulous fold hanging downward.

The incision along the margins of the opening in the parietes is carried deeply into the tissues so as to expose the muscles. If it is difficult to bring muscle through this incision, so as to form a flange-stitch, then all cicatricial tissue should be cut clean off so as to lay bare the muscle. The parietal incision is now closed by mass-sutures, which pass well back through the subcutaneous areolar tissue, take up a good bundle of muscle and a pinch of subperitoneal areolar tissue. If an abundance of muscle is forthcoming, fasciæ may be ignored. But if, as is too often the case, especially after an incision in the lower lateral parietes, which has severed the muscles and the fascia, there is little muscle near, then we must seek out and isolate the fascia of the external oblique, and bring it over the wound somehow, even if it is necessary to resect and turn over a flap. But muscle, being the best guard against hernia, should, if at all possible, be brought into the wound. It may be possible to detach a few bundles of muscular fibre; and this should be done rather than leave the wound closed away from the immediate neighborhood of muscle.

If there is much tension, the sutures should be placed very closely; and in any case they should not be removed for three weeks or a month.

This operation is a comparatively trifling one. As it does not open the abdomen, there is none of the thirst and other sequelæ, not to mention risk, that follow exposure of the abdominal cavity.

RADICAL CURE OF UMBILICAL HERNIA.

Here we have to deal not merely with a distended peritoneocutaneous sac, but with the firm, round, umbilical opening with its inner ring of dense fibrous tissue; and an operation must deal with both conditions. It is sometimes possible to deal with both in the same incision and by the same set of sutures; more frequently, however, it will be advisable to deal with each separately with separate suturing.

The operation may be described in stages.

(1) Lay open cutaneous coverings of the hernia from top to bottom. An entrance is made by a small incision over the

thinnest part which overlies bowel. At such a point skin and peritoneum may lie in very close contact, and then the opening is best made by pinching up a fold and cutting it through as in entering the peritoneum. Then with scissors, guided by forefinger, divide the tissues up to the limits of the hernia. Omental adhesions may be avoided. As most of the superfluous cutaneous tissue will be removed, it does not matter if the line of division is not straight.

(2) Return the bowel into the cavity, and place a sponge between it and the umbilical opening. If the bowel is not adherent, this is done easily enough. If there are adhesions, these are separated either by simple peeling or by ligation and cutting, as seems best. Adhesions on the bowel are dealt with as if they are not to be seen again; forcipressure, therefore, is not employed on the bowel. The bowel being returned, we have done with it; the sponge in the cavity keeps it out of the way.

(3) Deal with omentum. In most cases the omentum is adherent at many points in the sac where it has opened up the subcutaneous areolar tissues, and also to overlying peritoneum. In nearly all the omentum will have increased in size in the sac. The best plan, then, will be at once to ligate and divide the omentum at the narrowed neck or pedicle where it passes through the umbilicus; return the stump into the abdomen, and remove the extruded omentum with the peritoneal hernial sac. The peritoneal membrane will have to be removed either bodily or by peeling; it is superfluous first to remove adherent omentum, then to remove the tissues to which the omentum is adherent; it is more workman-like to remove both together.

In ligating the omental pedicle, a double transfixing and interlocking ligature of silk should be employed, and compression should be aided by pinching the line of ligature with a strong forceps. This does away with the risk of hæmorrhage from slipping of the tissues away from the ligature. The omental stump on division is pushed inside the abdomen behind the sponge, and the cavity is now permanently excluded from the field of operation.

(4) Remove superfluous skin and sac. The distal side of

the stump, with forceps attached, is now pulled out of the wound, and the sac is thereby everted and all adhesions and attachments made visible. The amount of skin to be removed is now decided upon, and the division is at once made by clean sweeps with the

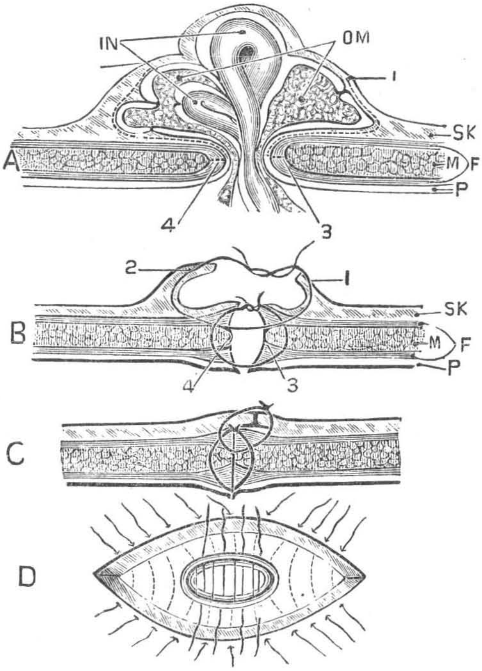

FIG. 7.—Radical cure of umbilical hernia.

A. Transverse section through hernia; IN, intestine herniated; OM, omentum in sac, hypertrophied and adherent; Sk, skin; F, fascia; P, peritoneum; 1 and 2, placed at the points where superfluous skin and sac are removed on the outer aspect, and where sac is detached and removed on the inner; 3 and 4, incisions down to recti through fascial surrounding of ring. The dotted lines between 1 and 3 and 2 and 4 mark the line of separation of sac.

B. Same,—bowel returned, omentum and sac removed; superfluous tissue removed; structures around ring opened up (3 and 4) and sutures inserted. References as in A.

C. Suturing completed.

D. Bird's-eye view (on diminished scale) of wound area with sutures inserted ready for tying. (Part of one of the umbilical sutures is by mistake omitted.)

scissors. This, in many cases, will let free the omentum as well. Adhesions in some cases are found in the deeper portions of the sac; by dragging on the omentum and using the finger or blunt dissector the sac is separated from surrounding areolar tissues down to the circumference of the umbilical opening and then bodily cut off with the adherent and herniated omentum. It is useless to waste time in separating sac from skin where both are to be cut away; separation is begun only after superfluous tissues are removed. The peritoneal covering is now stripped off all around the umbilical opening and pushed inside the abdomen.

(5) Open up the free margin of the umbilical ring so as to liberate the edges of the recti. In harmony with the principles already contended for, this is the most important single element in the operation. A deep cut (with a knife with bent blade, if necessary) is made into the dense fibrous tissue which surrounds the ring, completely dividing it down to the muscle. The muscle will either at once spring into the opening or will come after a little coaxing. This finishes the cutting part of the operation.

(6) Insert the sutures. For most cases it is advisable to use a double row of sutures: one deep and dealing with the umbilical opening; the other half deep and superficial, dealing with the cutaneous and outer fascial tissues. Silkworm gut is probably best for both. The deep sutures are inserted, first, through the outer edge of the divided dense fascia; then deeply into the muscle; then through the inner edge of fascia; and then through the subperitoneal fibrous tissue and carried through the opposite side in reverse order (Fig. 7, B, 3, 4). From four to six interrupted sutures will be required, according to the size of the opening. When they are inserted, the sponge is removed from the abdominal cavity and they are then tied and the ends cut short. Then the cutaneous tissues are brought together. It is well, if possible, to bring out-lying areolar tissue into the wound, and to bury the outer suture completely. The sutures pass a little way into the deep tissues between the deep sutures so as to help them (Fig. 7, B, C, D), and one placed in half radiating

fashion from the umbilicus so as to bring the whole outer wound into the smallest possible compass.

Occasionally one set of sutures may, with propriety, be made to serve, and I have had several successful cases done this way. But the sutures are placed with more accuracy and ease in a double row, and probably they give greater security.

The operation thus concluded is dressed in the ordinary way. The outer stitches may, with advantage, be left in for a fortnight or three weeks.